

Product Information Bulletin

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2006 OBC Thermal Resistance Requirements for Part 9 Buildings

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The Advantage ICF System® is an energy efficient building system consisting of a monolithic layer of expanded polystyrene (EPS) insulation over the interior and exterior face of a concrete core. This bulletin provides information on how wall assemblies built using the Advantage Insulating Concrete Forming (ICF) System comply with 2006 Ontario Building Code requirements.

The energy efficiency of walls built with the Advantage ICF System versus wood frame construction are compared using “**effective thermal resistance**”, a measure of the overall thermal resistance of a building assembly. Wood studs used in wood-frame construction act as thermal bridges reducing the overall effective thermal resistance of a wall assembly. The effective thermal resistances of assemblies are calculated using the formula below provided in the 1997 Model National Energy Code for Houses (MNECH).

$$\text{Effective Thermal Resistance} = \frac{100\%}{\frac{\% \text{ Area with Framing}}{\text{RSI (R) Framed Portion}} + \frac{\% \text{ Area Without Framing}}{\text{RSI (R) Insulated Portion}}}$$

The effective thermal resistance for an above-grade wall assembly built with the Advantage ICF System wall is provided in Table 1.

Table 1 - Effective Thermal Resistance – 152-mm (6”) Concrete Wall Using Advantage ICF System

Wall Component Description	RSI	R
Outside Air Film	0.03	0.17
Metal Siding	0.11	0.62
Sheathing Paper	0.01	0.06
Type 2 Expanded Polystyrene Insulation	1.87	10.61
152-mm Concrete Wall - Normal Density	0.06	0.35
ICF Cross-Tie - See note 1 below	----	----
Type 2 Expanded Polystyrene Insulation	1.87	10.61
12.7-mm Gypsum Wall Board	0.08	0.45
Inside Air Film	0.12	0.68
Effective Thermal Resistance	RSI-4.14 m²·°C/W	R-23.54 ft²·hr·°F/BTU

Note 1: MNECH, Sentence 3.2.1.2.(3) states that ties and other minor structural members that must completely penetrate the building envelope to perform their intended function need not be taken into account in calculating the thermal resistance of an assembly provided that the insulation is installed tight against the outline of the penetration.

Conformance to the 2006 OBC energy efficiency requirements for Part 9 residential buildings can be confirmed for building assemblies based upon either subsection 12.3.2 – **Thermal Insulation for Buildings of Residential Occupancy** or subsection 12.3.3. – **Thermal Design for Buildings of Residential Occupancy Within the Scope of Part 9**. Minimum thermal resistance requirements complying with these subsections are provided in Table 2.

Table 2 - 2006 OBC Thermal Resistance Requirements

Building Element Exposed to the Exterior or to Unheated Space	Zone 1 (< 5000 degree-days)		Zone 2 (≥ 5000 degree-days)	
	RSI	R-value	RSI	R-value
Table 12.3.2.1 – Minimum Thermal Resistance of Insulation to be installed				
Wall other than foundation wall	3.34	19.0	4.22	24.0
Table 12.3.3.3 – Minimum Thermal Resistance of Building Assemblies				
Wall other than foundation wall	3.80	21.6	4.67	26.5

Tables 3 provides effective thermal resistance calculations for wood frame wall assemblies based upon the requirements from the 2006 OBC as noted in Table 2.

Table 3 - Effective Thermal Resistance Calculations for Wood Frame Wall Assemblies

Wood-Frame Wall c/w Insulating Sheathing Board	2006 OBC Zone 1				2006 OBC Zone 2			
	RSI _F	RSI _I	R _F	R _I	RSI _F	RSI _I	R _F	R _I
Effective Thermal Resistance Calculation per 2006 OBC Table 12.3.2.1 (See note 1)								
Outside Air Film (above grade)	0.03	0.03	0.17	0.17	0.03	0.03	0.17	0.17
Metal Siding	0.11	0.11	0.62	0.62	0.11	0.11	0.62	0.62
Sheathing Paper	0.01	0.01	0.06	0.06	0.01	0.01	0.06	0.06
Type 1 EPS Insulation	0.87	0.87	4.94	4.94	0.87	0.87	4.94	4.94
Stud Cavity Insulation	----	2.47	----	14.03	----	3.35	----	19.03
Wood Stud Framing	0.72	----	4.10	----	1.13	----	6.44	----
12.7-mm Gypsum Wall Board	0.08	0.08	0.45	0.45	0.08	0.08	0.45	0.45
Inside Air Film	0.12	0.12	0.68	0.68	0.12	0.12	0.68	0.68
Total Thermal Resistance	1.94	3.69	11.02	20.96	2.35	4.57	13.37	25.96
Effective Thermal Resistance	RSI-3.15 m²·°C/W		R-17.89 ft²·hr·°F/BTU		RSI-3.88 m²·°C/W		R-22.02 ft²·hr·°F/BTU	
Effective Thermal Resistance Calculation per 2006 OBC Table 12.3.3.3 (See note 2)								
Outside Air Film (above grade)	0.03	0.03	0.17	0.17	0.03	0.03	0.17	0.17
Metal Siding	0.11	0.11	0.62	0.62	0.11	0.11	0.62	0.62
Sheathing Paper	0.01	0.01	0.06	0.06	0.01	0.01	0.06	0.06
Type 1 EPS Insulation	0.98	0.98	5.57	5.57	0.98	0.98	5.57	5.57
Stud Cavity Insulation	----	2.47	----	14.03	----	3.34	----	19.03
Wood Stud Framing	0.72	----	4.10	----	1.13	----	6.44	----
12.7-mm Gypsum Wall Board	0.08	0.08	0.45	0.45	0.08	0.08	0.45	0.45
Inside Air Film	0.12	0.12	0.68	0.68	0.12	0.12	0.68	0.68
Total Thermal Resistance	2.05	3.80	11.65	21.58	2.46	4.67	13.99	26.52
Effective Thermal Resistance	RSI 3.27 m²·°C/W		R-18.57 ft²·hr·°F/BTU		RSI 3.99 m²·°C/W		R 22.67 ft²·hr·°F/BTU	

Notes to Table 3:

1. The total thermal resistance for **insulation components** (highlighted in table) equal to RSI-3.34 for Zone 1 calculation and RSI-4.22 for Zone 2 calculation.
2. The total thermal resistance of the **insulated portion** of wall assembly (highlighted in table) equal to RSI-3.80 for Zone 1 calculation and RSI-4.67 for Zone 2 calculation.

2006 OBC Zone 1 and 2 Compliance:

The thermal resistance of a wall built with the Advantage ICF System conforms to 2006 OBC requirements for Zone 1 based upon either minimum thermal resistance of the insulation component per Table 12.3.2.1 or minimum thermal resistance of the building assembly per Table 12.3.3.3. As well, the effective thermal resistance of the Advantage ICF wall assembly exceeds that of the wood-frame wall meeting minimum thermal resistance requirements with studs at 406 mm (16") on center.

The thermal resistance of a wall built with the Advantage ICF System is slightly below 2006 OBC requirements for Zone 2 based upon minimum thermal resistance of the insulation component per Table 12.3.2.1 and minimum thermal resistance of the building assembly per Table 12.3.3.3. However, the monolithic layer of expanded polystyrene (EPS) insulation over the interior and exterior face of an Advantage ICF System wall increases the energy efficiency of system so that the **effective thermal resistance** of the wall assembly is greater than that of a wood-frame wall. In addition, the monolithic layer of insulation significantly decreases air leakage and associated heat loss versus typical wood-frame construction.

2006 OBC, Article 12.3.3.6. permits the thermal resistance of the insulated portion of a building assembly to be reduced by not more than 20 per cent from that required in Table 12.3.3.3. This reduction in thermal resistance is permitted where it can be shown that the total calculated heat loss from the building enclosure does not exceed the heat loss that would result if the enclosure were constructed in conformance with the minimum thermal resistance requirements in Table 12.3.3.3.

The thermal resistance of the insulated portion of a wall built with the Advantage ICF System is approximately 11% less than that required by Table 12.3.3.3. However, because of the elimination of the thermal bridges and the monolithic insulation layer provided by the Advantage ICF System wall assembly, the effective thermal resistance is higher and would result in reduced heat loss in comparison to a wood frame wall assembly complying with Zone 2 requirements. Therefore, the Advantage ICF System complies with the requirements of 2006 OBC, Article 12.3.3.6.